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Operational Test and Evaluation (OT&E) Test Plan for the Federal Aviation Administration (FAA) Bulk Weather Telecommunications Gateway (FBWTG)

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16. Abstract

The Federal Aviation Administration (FAA) Bulk Weather Telecommunications Gateway (FBWTG) is a communications gateway to the FAA for high-resolution gridded weather forecast data (e.g., Eta Forecast Model, Aviation (AVN) and Rapid Update Cycle (RUC) and airborne observation data (e.g., Meteorological Data Collection and Reporting System (MDCRS)) from the National Weather Service Telecommunications Gateway (NWSTG). The FBWTG will provide the capability to simultaneously and continuously receive high-resolution gridded weather forecast data and MDCRS data from the NWSTG and disseminate this information to other National Airspace System (NAS) subsystems.

The purpose of this plan is to provide an overview of the Operational Test and Evaluation (OT&E) phase of System Testing for both pathways; NWSTG to FBWTG located at the Air Traffic Control System Command Center (ATCSCC), and FBWTG to National Weather Service (NWS) Filter Unit (NFU)-Test device located at the William J. Hughes Technical Center. To accomplish this objective, the FBWTG, an end-state subsystem, must be operationally integrated with NAS subsystems. This plan establishes test strategy, test objectives, test criteria, and detailed test and evaluation descriptions to be used in the generation of the Test Procedures and Test Report's entrance and exit criteria for the program.

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EXECUTIVE SUMMARY

The Federal Aviation Administration (FAA) Bulk Weather Telecommunications Gateway (FBWTG) adds the capability for the Air Traffic Control System Command Center (ATCSCC) Weather and Radar Processor (WARP) System to acquire high resolution gridded data from the National Weather Service (NWS) Telecommunications Gateway (NWSTG), and disseminate it to the WARP Systems and the Integrated Weather System (ITWS) National Weather Service Filter Unit (NFU).

Formal Operational Test and Evaluation (OT&E) will be conducted by the government at the ATCSCC, located in Herndon, VA, upon successful completion of Harris Corporation's Factory Acceptance Test (FAT) at the contractor's site. Data will be disseminated to the NFU-Test device at the William J. Hughes Technical Center, Atlantic City International Airport, for validation of the ITWS/FBWTG functionality.

This Test Plan describes all testing to be conducted by the Integrated Product Team (IPT) to determine whether Acquisition Program Baseline (APB) requirements have been met, whether Operational Issues (OI) have been resolved, and whether the new system is suitable for use in the National Airspace System (NAS).

1. INTRODUCTION.

The Federal Aviation Administration (FAA) Bulk Weather Telecommunications Gateway (FBWTG) is added as a new subsystem to the Air Traffic Control System Command Center (ATCSCC) Stage 1 Weather and Radar Processor (WARP) System to acquire high resolution forecast data and airborne observation messages from the National Weather Service Telecommunications Gateway (NWSTG) and disseminate it to the WARP Systems and the Integrated Weather Systems (ITWS) National Weather Service (NWS) Filter Unit (NFU).

Formal Operational Test and Evaluation (OT&E) will be conducted by the government at the ATCSCC, located in Herndon, VA, upon successful completion of Harris Corporation's Factory Acceptance Test (FAT) at the contractor's site. Data will be disseminated to the NFU-Test device at the William J. Hughes Technical Center for validation of the ITWS/FBWTG functionality.

This Test Plan describes all testing to be conducted by the Integrated Product Team (IPT) to determine whether Acquisition Program Baseline (APB) requirements have been met, whether Operational Issues (OI) have been resolved, and whether the new system is suitable for use in the National Airspace System (NAS).

1.1 BACKGROUND.

The FAA has identified the need for FBWTG, which is a subsystem of the WARP System located at the ATCSCC.

The purpose of the FBWTG is to serve as an FAA gateway for high-resolution gridded weather forecast data (e.g., Eta Forecast Model, Aviation (AVN) and Rapid Update Cycle (RUC) and airborne observation data (e.g., Meteorological Data Collection and Reporting System (MDCRS)) from the NWSTG. The FBWTG will provide the capability to simultaneously and continuously receive high-resolution gridded weather forecast data and MDCRS data from the NWSTG and disseminate this information to other NAS subsystems.

1.2 PURPOSE.

The OT&E testing is performed to determine the Operational Suitability and Effectiveness of the FBWTG system under operationally realistic conditions. The purpose of this plan is to provide an overview of the OT&E phase of system testing for both pathways; NWSTG to FBWTG located at the ATCSCC, Herndon, VA, and FBWTG to NWS NFU-Test device located at the Technical Center. To accomplish this objective, the FBWTG, an end-state subsystem, must be operationally integrated with NAS subsystems. This plan establishes test strategy, test objectives, test criteria, and detailed test and evaluation descriptions to be used in the generation of the Test Procedures and Test Report's entrance and exit criteria for the program.

System Test consists of Development Test and Evaluation (DT&E), Contractor Site Acceptance Test (SAT) and FAA OT&E. The Test Plan, described in this document, and the follow-on procedures will be prepared and approved to be consistent with the Acquisition Management System (AMS) Test and Evaluation (T&E) Process Guidelines. The DT&E and SAT Test Plans will be the responsibility of the contractor and witnessed by ACT-320.

1.3 SCOPE.

The Operational Test Plan (OTP) forms the basis for the Operational Test (OT) Program. This Test Plan describes all testing to be conducted by the IPT to determine whether APB requirements have been met, whether OIs have been resolved, and whether the new system is suitable for use in the NAS.

Three major components of the OTP are described: NAS Integration, Operational Suitability, and Operational Effectiveness. The OTP also describes the various planning and preparation activities required prior to OT, the operational testing strategy/approach, test resource requirements, and test entry conditions. This Plan contains an OT schedule and a Verification Requirements Traceability Matrix (VRTM) (appendix A). Testing of the internal interfaces to the WARP subsystem is beyond the scope of this Test Plan, and will be tested during the DT&E phase. Thus, verification of the interface between the NWS/WARP will not be addressed in this Test Plan.

Formal OT&E will be conducted by the government at the ATCSCC, located in Herndon, VA, upon successful completion of Harris's Factory Acceptance Test (FAT) at the contractor's site. Data will be disseminated to the NFU-Test device at the Technical Center for validation of the ITWS/FBWTG functionality. More detail of the OT&E test program is provided in section 4 of this document.

2. REFERENCE DOCUMENTS.

The following specifications, standards, and other documents form a part of this Test Plan.

2.1 FAA DOCUMENTS.

FAA-E-2898	Weather and Radar Processor (WARP) System Specification
FAA-G-2100F	Electronic Equipment, General Requirements

2.2 OTHER DOCUMENTS.

AMS	Acquisition Management System (AMS) Test and Evaluation (T&E) Process Guidelines, dated February 1999
NAS-IC-XXXXXXXX	FAA Bulk Weather Telecommunications Gateway (FBWTG) to WARP Interface Control Document (ICD)
NAS-IR-90029414	Interface Requirements Document (IRD) for National Weather Service Telecommunications Gateway (NWSTG) to Federal Aviation Administration Bulk Weather Telecommunications Gateway (FBWTG)
NAS-IR-94142514	Interface Requirements Document (IRD) for Federal Aviation Administration Bulk Weather Telecommunication Gateway (FBWTG) to Integrated Terminal Weather System (ITWS)
NAS-XX-XXXXX	FAA Bulk Weather Telecommunications Gateway (FBWTG) Operational Requirements Document (ORD), dated August 14, 1997

3. SYSTEM DESCRIPTION.

3.1 SYSTEM OVERVIEW.

Initially, the FBWTG will acquire high-resolution gridded weather forecast data and airborne observation data messages from the NWSTG and disseminate the data to the Integrated Terminal Weather System (ITWS) and WARP. The FBWTG will serve as a subsystem of the WARP system located at ATCSCC.

Figure 3.1-1 depicts the FBWTG Gateway Overview. The NWSTG provides the FBWTG with files containing messages that provide forecast information and meteorological observations. These messages are accumulated by the NWSTG over a preset period of time, sorted by product type, and transferred to the FBWTG. The FBWTG is responsible for dissemination of NWS provided messages to the ITWS NFU and WARP.

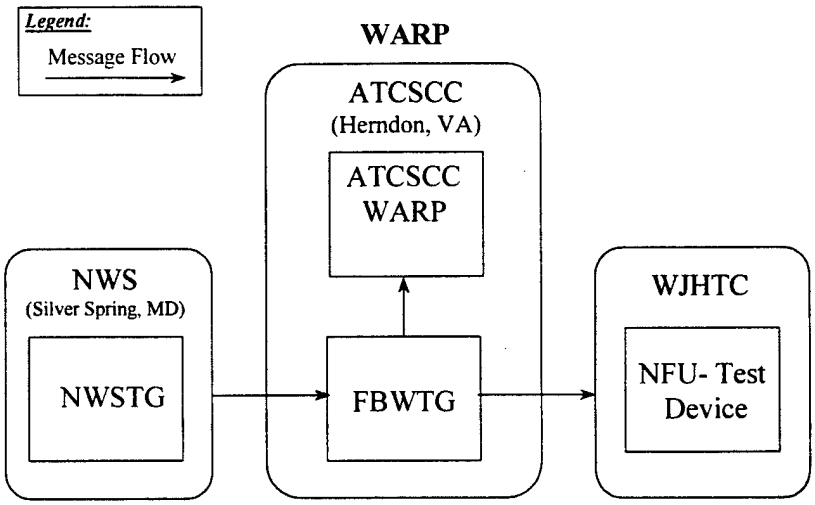

FIGURE 3.1-1. FBWTG GATEWAY OVERVIEW

3.2 INTERFACES.

The demarcation points and protocols used between the NWSTG and the FBWTG are defined in the NWSTG to FBWTG Interface Requirements Document (IRD), NAS-IR-90029414. The demarcation points and protocols used between the FBWTG and ITWS are defined in the FBWTG to ITWS IRD, NAS-IR-94142514. The demarcation points and protocols used between the FBWTG and WARP are defined in the FBWTG to WARP ICD.

3.2.1 Operational Modes Overview.

The operational modes of the FBWTG consists of the following:

a. Acquisition Mode
b. Dissemination Mode
c. Data management Mode
d. System Monitoring and Control Mode

3.2.1.1 Acquisition Mode.

The FBWTG will acquire weather files containing World Meteorological Organization (WMO) messages from the NWSTG as specified in the NWSTG/FBWTG IRD.

3.2.1.2 Dissemination Mode.

The FBWTG will automatically disseminate acquired files to ITWS as specified in the FBWTG/ITWS IRD; and WMO messages to WARP as specified in WARP/FBWTG ICD To Be Determined (TBD).

3.2.1.2.1 Performance.

The FBWTG will meet the performance requirements for dissemination of files to ITWS and WMO messages to WARP:

TABLE 3.2.1.2.1-1. FILE DISSEMINATION

INTERFACE	AVERAGE	99.5 PERCENTILE	99.95 PERCENTILE
ITWS	3 seconds	8 seconds	10 seconds
WARP	3 seconds	8 seconds	10 seconds

- Time is measured from notification of receipt of the last bit of the NWS file until the first bit of the data to be disseminated is placed on the NAS subsystem interface.
- The FBWTG will disseminate an NWS file/WMO message to the respective interfaces within 30 seconds of receipt of the file from the NWSTG.

3.2.1.3 Data Management Mode.

The FBWTG will retain:

a. The past two model runs for the AVN and Eta model;
b. The past two model runs of both the 1-hourly and 3-hourly RUC model;
c. One hour of MDCRS data.

The FBWTG periodically purges the database of the oldest data, while ensuring retention of data as listed above.

The FBWTG maintains a reception log containing a separate entry for each file that has been received from the NWSTG. These logs include; data type, model run (if file contains high-resolution gridded weather data) or hour in which MDCRS observations were taken, and hour/minute in which the file was pushed to the FBWTG. The FBWTG maintains a dissemination log containing a separate entry for each file that has been disseminated to external destinations. These logs include; data type, model run (if file contains high-resolution gridded data) or hour in which MDCRS observations were taken, and hour/minute in which the file/WMO message data was pushed or transmitted to WARP and ITWS.

3.2.1.4 System Monitoring and Control Mode.

The FBWTG maintains a system alert log containing a separate entry for each system alert.
For each event, the FBWTG system alert log contains the Universal Coded Time (UTC) for detection, specific nature of the event, identification of the originator, user or component, and, if applicable, additional diagnostic data.

The FBWTG maintains a resource utilization log containing the percentage of system resources used, averaged over 15 minutes, and measured every 1 minute for the following:

a. Disk Utilization
b. Memory Paging Average
c. Internal Communication Bandwidth
d. Central Processing Unit (CPU) Utilization

The FBWTG system logs are available for display as follows:

a. All and/or selected portions of the system logs
b. Current logs as they are produced

3.3 ACTIVITIES LEADING TO OT&E TESTING.

FAT will be conducted by Harris Corporation at the contractor's site and witnessed by the FAA. Harris Corporation will provide a T&E plan that will ensure that the FBWTG subsystem is compliant with the specification requirements.

Harris Corporation will complete verification of the remaining FBWTG requirements during SAT at the Herndon, VA site. Harris Corporation will also conduct a series of system tests to verify the requirements that have not been previously verified and conduct appropriate regression tests. The SAT will be conducted using government-approved Harris Corporation furnished scenarios and a system configuration adapted with ATCSCC parameters.

Harris Corporation will also deliver and install a fully integrated configuration for the Herndon, VA site. Harris will also verify that the subsystem is fully operational; is tailored to specific site requirements; has complete documentation, tools, and test equipment; and is complete and ready for government operation and maintenance.

OT&E Testing will be conducted at the Herndon, VA site using the test-bed configuration described in paragraph 5.2.1 with support from NWS (Silver Spring, MD) and Harris Corporation.

4. TEST PROGRAM DESCRIPTION.

The FBWTG OT&E test effort will ensure that the FBWTG Subsystem is Operationally Effective and Operational Suitable and is able to be integrated into the NAS. Operational Effectiveness centers around the performance of the FBWTG System, while Operational Suitability centers on the maintainability of the FBWTG System.

4.1 TEST APPROACH.

The test will be run on operational hardware and the baseline software. All major functions and interfaces will be exercised during this test phase. Each test case is traceable to a specific requirement. Failure to complete the entire test case for any reason requires the test case to be restarted.

4.1.1 Test Objectives.

The primary objective of OT is to demonstrate that a new system is Operationally Effective and Suitable for use in the NAS, and that the NAS infrastructure is ready to accept the system. These tests focus on demonstrating that operational requirements have been met and that all Operational Issues (OIs) have been resolved.(See figure 4.1.1-1.)

The major components of OT are NAS Integration, Operational Suitability, and Operational Effectiveness tests, which are addressed in the following sections.

- NAS Integration testing verifies that the system interfaces to the existing elements of the NAS and that the NAS can operate with the new subsystem.

- Operational Suitability testing evaluates the degree to which a product intended for field use satisfies its availability, interoperability, reliability, maintainability, human factors, logistics, and documentation.

- Operational Effectiveness testing evaluates the degree to which a product accomplishes its mission when used by representative personnel in the expected operational environment. This testing includes capacity and NAS loading, degraded mode operations, security, and planned life cycle. OT effectiveness testing also assesses OIs.

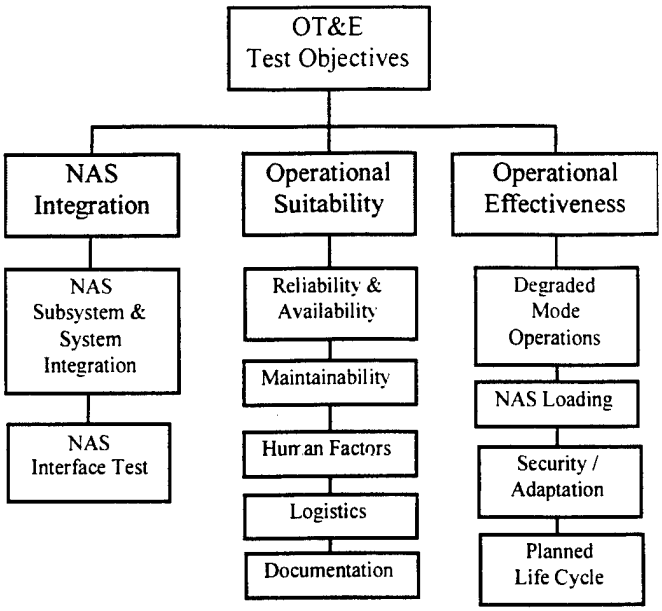

FIGURE 4.1.1-1. TEST OBJECTIVES

4.1.1.1 NAS Integration.

The objectives of NAS Integration Testing are defined below.

4.1.1.1.1 NAS Subsystem and System Integration Test.

The objective of this test is to verify the interfaces and product exchanges between the FBWTG, NWSTG and the NFU subsystems. This test is comprised of four test cases:

a. Acquisition Mode Test Case: File Transfer Protocol (FTP) and file registry
b. Dissemination Mode: FTP, product ordering and delivery time, and purge
c. Data Management Mode: purging, data retention, and operations log
d. System Monitoring and Control Mode: support concept

4.1.1.1.2 NAS Interface Test.

The objective of this test is to verify the requirements specified in the NWS / FBWTG and FBWTG / ITWS IRDs. This test is comprised of one test case:

a. Interface Test *(NOTE: This does not include the interface between the FBWTG / WARP.)*

4.1.1.2 Operational Suitability.

The objective of Operational Suitability Testing is to evaluate the degree to which the FBWTG intended for field use satisfies the requirements defined below. Test responses and comments to the OIs will be recorded by the test team on an OT&E Test Evaluation Matrix (appendix B) based on the Measure of Effectiveness (MOE), Measure Of Suitability (MOS), and Measure Of Performance (MOP) Definitions (table 4.1.1.2-1).

TABLE 4.1.1.2-1. MOE, MOS, AND MOP DEFINITIONS

MEASURE OF EFFECTIVENESS (MOE)	Operational Effectiveness addresses the degree to which a product accomplishes its mission when used by representative personnel in the expected operational environment.
MEASURE OF SUITABILITY (MOS)	Operational Suitability addresses the degree to which a product intended for field use satisfies its availability, reliability, maintainability, safety, and logistics.
MEASURE OF PERFORMANCE (MOP)	Quantitative/qualitative values which characterize the MOEs/MOSs. These values are measurable by a test process.

4.1.1.2.1 Reliability and Availability Test.

This test will be conducted to estimate and/or verify that the Reliability, Maintainability and Availability (RMA) requirements are achievable in an operational environment. RMA issues include Mean Time to Repair (MTTR), Mean Time Between Failures (MTBF) and FBWTG Availability and Reliability. In general, the RMA requirements cannot be fully tested during OT&E. Instead, data will be collected and retained during DT&E and OT&E to support analysis of the RMA performance.

4.1.1.2.2 Maintainability.

This test case will be conducted to validate the FBWTG's capability to identify and diagnose system faults and procedures to restore system operation via specific hardware and software maintenance tests.

4.1.1.2.3 Human Factors.

This test case will be conducted to evaluate operation and maintenance tasks of the FBWTG via Applicable Human Factors (HF) performance selected from the following list:

a. FBWTG Input/Output (I/O) Devices: System I/O display criteria adheres to the following:

   1. Menu Displays - Menus are well organized and are an aid to the maintenance technicians.
   2. Status Displays - All pertinent data is displayed logically and in an easy to use format.

b. Alarms/Alerts: Alarms/Alerts are adequate to attract attention but not unnecessarily disruptive. Status lights, which indicate proper system status, are readily and easily understood.

c. Error Detection: Input parameter limitations cannot be exceeded (e.g., incorrect values are detected and flagged, or rejected).

d. Safety: The system will be accessed to assure that it does not present any safety hazards to the user, the facility, or other interface systems.

4.1.1.2.4 Logistics.

This test case will be conducted to provide an overall assessment of the adequacy of the logistics support for Operational Suitability Issues:

a. Expediency: Spare parts, etc., can be obtained in a reasonable time.
b. Turn-Around: The system meets MTTR requirements.

4.1.1.2.5 Documentation.

This test case will be conducted to evaluate documents against the applicable test issues selected from the following documentation items:

a. Completeness: Sufficient documentation is provided to allow a working knowledge of the FBWTG.

b. Readability: Procedures and descriptions are written in an easy to understand manner.

c. Usability: Reference documentation is logically organized and easy to use.

d. Revisions: Contractor and/or COTS manuals, and all other documents will be assessed to assure that standard update procedures are followed and can be adequately maintained.

4.1.1.3 Operational Effectiveness.

The objective of Operational Effectiveness Testing is to evaluate the degree to which the FBWTG accomplishes its mission when used by representative personnel in the expected operational environment.

4.1.1.3.1 Degraded Mode Operations Test.

The objective of this test is to evaluate the ability of the FBWTG to tolerate and respond to circuit failures and outages. Based on the NWSTG, NFU outages, and link loss, product requests will be utilized to restore operations with minimum impact. This test is comprised of four test cases:

a. Failure Mode
b. Interface Failure Detection
c. Alert Notification and,
d. Return to Normal Notification

4.1.1.3.2 NAS Loading.

The objective of this test is to validate the NAS Loading performance by measuring the file dissemination time (see table 4.1.1.3.2-1).

TABLE 4.1.1.3.2-1. MESSAGE / FILE LOADING

INTERFACE	LOAD	AVERAGE	99.5 PERCENTILE	99.95 PERCENTILE
ITWS	TBD *(messages/hour)*	3 seconds	8 seconds	10 seconds
WARP	TBD *(messages/hour)*	3 seconds	8 seconds	10 seconds

TABLE 4.1.1.3.2-1. MESSAGE / FILE LOADING

a. Time is measured from notification of receipt of the last bit of the NWS file until the first bit of the data to be disseminated is placed on the NAS subsystem interface.

b. The FBWTG will disseminate an NWS file/WMO message to the respective interfaces within 30 seconds of receipt of the file from the NWSTG.

4.1.1.3.3 Security/Adaptation Data.

The security test will demonstrate that the FBWTG subsystem has the necessary security procedures in place for an air traffic control (ATC) situation. In an operational setting, these include procedures to restrict access to the workstation by requiring specific user log-ins and passwords. Tests will verify that operators' classes are specified and are adaptable. All security anomalies need to be noted, with an audit of all matters involving security being maintained, and be accessible by authorized personnel.

Integrity of the FBWTG, NWSTG, and the NFU subsystems will be tested for security issues. This will include both proper and improper Internet Protocol (IP) addresses, and FTP operations. Passwords will be used to test the security of the system support functions.

Adaptation testing will insure that the government can modify an adaptation file using standard tools to rebuild the program and verify the changes.

4.1.1.3.4 Planned Life Cycle.

Upgradability of the FBWTG will be tested for future product upgrades and users. This will include upgrades from the NWS, National Center for Environmental Prediction (NCEP), and Aviation Weather Center (AWC) product and services upgrades, and commercially available software packages.

4.2 TEST AND ANALYSIS TOOLS.

Technical Center test labs will provide an NFU Test Device, System Monitor Functions/Tools, and Protocol Analyzer to sufficiently test FBWTG subsystem interfaces. The NFU Test Device capabilities are identified in table 4.2-1.

TABLE 4.2-1. NFU TEST DEVICE

ITEMS	FUNCTION
Communications Subsystem	Provides an external interface and communications
Data Reduction and Analysis Tool	Aids in the analysis of messages and products recorded
SUN workstation	Used to develop specific scenarios at Technical Center
SUN server	Used to perform specific server scenarios at Technical Center

4.2.1 System Monitor Functions / Tools.

The System Monitor (SM) functions will be used for NFU data recording, data analysis, file editing, file management and system monitoring, with selected data saved from these functions for further analysis (disk or line printer listings).

4.2.2 Protocol Analyzer.

The protocol analyzer will perform the following functions:

a. Verify IRD Requirements
b. Verify Message Formats
c. Measure Performance of File Dissemination

4.3 TEST AND EVALUATION DESCRIPTIONS.

The tables in this section identify the Test Identification (ID) numbers, the title of each test/evaluation, and description of the objective, criteria, approach, and duration of each test. These test descriptions will be used as the basis for the development of the OT&E procedures. These tables represent a subset of the OT&E VRTM, contained in appendix A of this plan.

4.3.1 Integration Testing.

Integration testing is divided into two test areas. Testing will examine system implementation and performance as reflected in paragraph 4.3.1.1.

4.3.1.1 National Airspace System Integration.

NAS INTEGRATION TEST/EVALUATION DESCRIPTIONS					
TEST ID NO.	***TITLE***	***OBJECTIVE (PARA. NUMBER)***	***CRITERIA***	***APPROACH***	***EXECUTION TIME***
I-01	NAS SUBSYSTEM AND SYSTEM INTEGRATION	4.1.1.1.1	Each of the FBWTG modes must be capable of operating as described in its System Specification (SPEC).	Execution of all FBWTG modes will be evaluated in a NAS operational environment.	*NOTE 1*

NAS INTEGRATION TEST/EVALUATION DESCRIPTIONS

TEST ID NO.	*TITLE*	*OBJECTIVE (PARA. NUMBER)*	*CRITERIA*	*APPROACH*	*EXECUTION TIME*
I-02	NAS INTERFACE TESTING	4.1.1.1.2	Each one of the FBWTG interfaces must be capable of operating as described in its Interface Requirements (IR) in a NAS environment. Verify requirements specified in the NAS-IR-90029414 and NAS-IR-94142514.	The subsystem will be evaluated for interoperability within the NAS environment.	*NOTE 1*

NOTE 1: TEST DURATION WILL BE DETERMINED DURING OT&E TEST PROCEDURE DEVELOPMENT AND DRY RUN.

4.3.2 Operational Suitability Testing.

Operational testing is divided into five test areas. Testing will examine system suitability in paragraph 4.3.2.1.

4.3.2.1 Operational Suitability.

OPERATIONAL SUITABILITY					
TEST ID NO.	***TITLE***	***OBJECTIVE (PARA. NUMBER)***	***CRITERIA***	***APPROACH***	***EXECUTION TIME***
S-01	RELIABILITY AND AVAILABILITY	4.1.1.2.1	FBWTG must be capable of operating over a 72-hour period without interruption of service while under operational conditions.	FBWTG will operate continuously for a 72-hour period. During this period all system operating modes will be exercised. A scenario based on System Maintenance and support function will be exercised.	*NOTE 1*

OPERATIONAL SUITABILITY					
TEST ID NO.	***TITLE***	***OBJECTIVE (PARA. NUMBER)***	***CRITERIA***	***APPROACH***	***EXECUTION TIME***
S-02	MAINTAINABILITY	4.1.1.2.2	Tasks will evaluate specific diagnostic tools to ensure usability, procedures understanding, and effectiveness of the diagnostics to isolate and detect system faults. Test procedures will also require specialists to capture diagnostic data for subsequent retrieval and forwarding as necessary.	Test participants will evaluate the results of each operational test procedure to ensure FBWTG provides effective and suitable results for operating, maintaining and supporting FBWTG.	*NOTE 1*
S-03	HUMAN FACTORS	4.1.1.2.3	Test procedures will provide overall assessment of Human Factors for FBWTG subsystem.	Test participants will evaluate the results of each operational test procedure to ensure FBWTG provides effective and suitable results for operating, maintaining and supporting FBWTG.	*NOTE 1*

OPERATIONAL SUITABILITY					
TEST ID NO.	***TITLE***	***OBJECTIVE (PARA. NUMBER)***	***CRITERIA***	***APPROACH***	***EXECUTION TIME***
S-04	LOGISTICS	4.1.1.2.4	Test procedures will provide overall assessment of Logistics for FBWTG subsystem.	Test participants will evaluate the results of each operational test procedure to ensure FBWTG provides effective and suitable results for operating, maintaining, and supporting FBWTG.	*NOTE 1*

OPERATIONAL SUITABILITY					
TEST ID NO.	***TITLE***	***OBJECTIVE (PARA. NUMBER)***	***CRITERIA***	***APPROACH***	***EXECUTION TIME***
S-05	DOCUMENTATION	4.1.1.2.5	Test procedures will provide overall assessment of Documentation for FBWTG subsystem.	Test participants will evaluate the results of each operational test procedure to ensure FBWTG provides effective and suitable results for operating, maintaining, and supporting FBWTG.	*NOTE 1*
NOTE 1: TEST DURATION WILL BE DETERMINED DURING OT&E TEST PROCEDURE DEVELOPMENT AND DRY RUN.					

4.3.3 Operational Effectiveness Testing.

Operational Effectiveness testing is divided into four test areas. Testing will examine system effectiveness in paragraph 4.3.3.1.

4.3.3.1 Operational Effectiveness.

OPERATIONAL EFFECTIVENESS					
TEST ID NO.	***TITLE***	***OBJECTIVE (PARA. NUMBER)***	***CRITERIA***	***APPROACH***	***EXECUTION TIME***
E-01	DEGRADED MODE OPERATIONS	4.1.1.3.1	FBWTG must be able to detect single and multiple Hardware / Software fault and recover without major disruptions to system operation. In case of a catastrophic failure (e.g., Power), FBWTG must be capable of being brought back to its operational status in the time specified in the SOW and SPEC.	While FBWTG Operational Software is running, single and multiple faults, including power failures, will be induced to hardware / software elements in accordance with prepared scripts. Multiple faults will consist of a single area fault induced in conjunction with one or more additional faults. The operation of the system will be evaluated during the period from fault insertion to recovery. In particular, the ability to detect and report the fault will be evaluated.	*NOTE 1*
END TO END PERFORMANCE TESTING WILL BE PERFORMED IN CONJUNCTION WITH DEGRADED OPERATIONS TESTING.					

OPERATIONAL EFFECTIVENESS					
TEST ID NO.	***TITLE***	***OBJECTIVE (PARA. NUMBER)***	***CRITERIA***	***APPROACH***	***EXECUTION TIME***
E-02	NAS LOADING	4.1.1.3.2	(TBD)	(TBD)	*NOTE 1*

OPERATIONAL EFFECTIVENESS					
TEST ID NO.	***TITLE***	***OBJECTIVE (PARA. NUMBER)***	***CRITERIA***	***APPROACH***	***EXECUTION TIME***
E-03	SECURITY / ADAPTATION DATA	4.1.1.3.3	Security on the FBWTG System must be maintained by verifying the system will accept correct passwords coming from correct IP addresses and reject any combination of incorrect passwords and IP addresses. FBWTG must be capable of modifying FTP parameters for communication to exist. Discretionary access control to protect objects from unauthorized access, by single user or groups, and permission granted only to authorized users.	With the Harris Support System, attempt to log onto to the system with an incorrect password and verify rejection. Using a connected computer from the FAA Intranet attempt to connect to the system via IP address and correct password, observe the rejection. Test participants will evaluate the results of each parameter change to FBWTG. Employing user log-ons and passwords verify that unauthorized users are denied access functions and that only specific designated users can authorize new users and passwords.	*NOTE 1*

OPERATIONAL EFFECTIVENESS					
TEST ID NO.	***TITLE***	***OBJECTIVE (PARA. NUMBER)***	***CRITERIA***	***APPROACH***	***EXECUTION TIME***
E-04	PLANNED LIFE CYCLE	4.1.1.3.4	Upgradability of the FBWTG will be tested for future product upgrades.	(TBD)	*NOTE 1*
NOTE 1: TEST DURATION WILL BE DETERMINED DURING OT&E TEST PROCEDURE DEVELOPMENT AND DRY RUN.					

5. TEST MANAGEMENT.

5.1 TEST MANAGEMENT ORGANIZATION.

The following paragraphs describe the structure and composition of the FBWTG OT&E test organization, and identify the personnel responsible for the planning and conduct of the test activities. Described herein are the roles and responsibilities of the participating organizations (table 5.1-1).

TABLE 5.1-1. TEST MANAGEMENT ORGANIZATION

ORGANIZATION	RESPONSIBILITY
AUA Office of Air Traffic Systems Development	Provides FBWTG Product Team Leader for NAS acquisition program. Provides funding and support resources to ACT-320 for T&E effort. Distributes contractor test documents for review, and returns comments to contractor. Reviews and co-approves all internal and external test documents relating to FBWTG. Provides FAA management with program status.
ACT-320 Weather Branch	ACT-320 provides a Product Team Test Lead who acts as an agent of the FBWTG T&E program. This includes; coordinating tests, ensuring that all test requirements are satisfied, conducting OT&E, approval of exit criteria, and assures that tests are performed in accordance with approved procedures.
AOS Operational Support Service	Determination of Operational Suitability, participation in OTP development, review OT&E Integration requirements, plans, procedures, tests, and reports. Participate in the preparation, review, and conduct of OT&E.
Harris Corporation Support Service	Provide on-site technical assistance and support for the OT&E Test phase.

5.2 SYSTEM CONFIGURATION MANAGEMENT.

During DT&E, Harris will conduct each test activity using Configuration Management (CM) control documented in the government-approved Program Management Plan (PMP). The government will conduct configuration audits in accordance with the FBWTG Statement of Work (SOW). Audits commence before and complete after successful completion of FAT.

5.2.1 Test-Bed Configuration.

During OT&E, the FAA will be responsible for System CM of the test-bed environment, depicted in figure 5.2.1-1. The FAA will also record/maintain all documented anomalies, deviations, and waivers generated during OT&E.

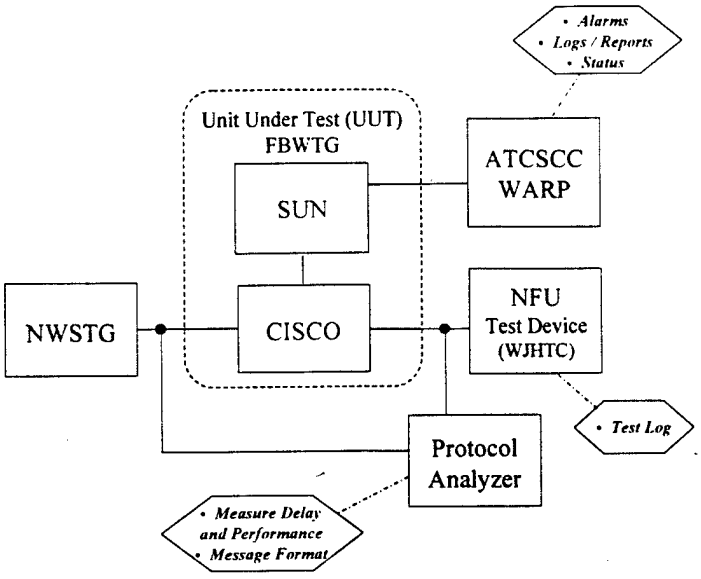

FIGURE 5.2.1-1. TEST-BED CONFIGURATION

5.3 OT&E TEST ENTRY CRITERIA.

Formal OT&E testing will begin pending successful completion of the following activities/conditions:

a. Harris Corporation has successfully completed FAT Testing at the contractor site.
b. FAA OT&E Test Plans and Procedures have been approved.
c. Availability of the NWSTG and telecommunications pathway at the key site.

5.4 TEST EXECUTION.

Test execution will commence upon completion of OT&E dry runs, and verification of the red-lined test procedures.

All collected data will be compiled and analyzed. Where applicable, system/operational trouble reports will be generated to document all anomalies/discrepancies identified during OT&E. Where necessary, retest will be conducted to verify any fixes implemented to address/resolve system/operational deficiency reports prior to FAA approval/closure.

5.5 OT&E TEST EXIT CRITERIA.

Completion of OT&E testing depends on evaluation of the identified system operational requirements, satisfactory evaluation of suitability issues, and the resolution of anomalies/issues identified during testing.

A key element of the OT&E Test Plan is the exit criteria;

a. All test scripts have been executed.

b. All Program Trouble Reports (PTRs) must have been satisfactorily resolved, with government agreement on the resolution

c. All changes made as a result of PTRs have been tested.

d. All documentation associated with the software must be updated to reflect changes made during OT&E testing.

e. The Test Rreport has been reviewed and approved.

5.6 OPERATIONAL TEST REPORTS.

An OT&E Quick Look Test Report will be published within 10 working days after completion of OT&E testing and a final Test Report will be published 30 calendar days after completion of OT&E testing. The report will provide assessments and documented accounts of the test activities, including execution of test procedures, test results, data analysis, identification of participants, test schedule, anomalies, deficiencies, and deviations.

5.7 TROUBLE REPORTING.

Throughout the execution of the OT&E test proceedings, PTRs will be generated against the system and/or program undergoing testing and evaluation. All anomalies/discrepancies will be documented via PTRs, Review Item Discrepancies (RIDs), and/or Action Items (AIs). A single form will be used to capture the anomalies/discrepancies. The form will contain a check box that will identify the category, severity level and priority of the problem identified. FAA approval of the proposed resolution strategy, implementation, and verification of the resolution is required prior to FAA closure of the PTRs.

5.7.1 Program Trouble Reports (PTR).

PTRs are generated to document any discrepancies or anomalies encountered during OT&E. These records provide a mechanism, by which traceability and repeatability of the test proceedings are maintained. (See appendix C.)

5.7.2 Review Item Discrepancies (RIDs).

RIDs are generated to identify and record any documentation-related discrepancies or deficiencies encountered during OT&E.

5.7.3 Action Items (AIs).

AIs are generated to document and track issues and activities that require completion and/or resolution.

5.8 OPERATIONAL TEST SCHEDULE.

The FAT and OT&E Test Schedule is as follows, see table 5.8-1.

TABLE 5.8-1. OPERATIONAL TEST SCHEDULE

TASK / ACTIVITY	DURATION	START DATE
Setup	1 day *	TBD
Dry Run	1 day *	TBD
Test Conduct	3 days *	TBD
PTRs, Quick Look Reports, Regression Testing	10 days *	TBD
Final Report	30 days **	TBD

* Working days
** Calendar days

5.9 PLANNING CONSIDERATIONS AND LIMITATIONS.

Limitations to the scope of OT&E have not yet been defined.

6. VERIFICATION METHODS.

The verification methods that can be used at any of the three verification levels are as follows;

a. Inspection (I) – Inspection is a method of verification to determine compliance without the use of special laboratory equipment, procedures, or services, and consists of a non-destructive static-state examination of the hardware, software, and/or the technical data and documentation.

b. Test (T) – Test is a method of verification wherein performance is measured during or after the controlled application of functional and/or environmental stimuli. Quantitative measurements are analyzed to determine the degree of compliance. The process uses standardized laboratory equipment, procedures, and/or services.

c. Demonstration (D) – Demonstration is a method of verification where qualitative determination of properties is made for a configuration item, including software and/or the use of technical data and documentation. The items being verified are observed, but not quantitatively measured, in a dynamic state.

d. Analysis (A) – Analysis is a method of verification where hardware or software designs are compared with known scientific and technical principles, procedures, and practices to estimate the capability of the proposed design to meet the mission and system requirements.

e. (X) – Not Applicable

7. ACRONYMS AND ABBREVIATIONS.

A	Analysis
AI	Action Item
AMS	Acquisition Management System
APB	Acquisition Product Baseline
ATC	Air Traffic Control
ATCSCC	ATC System Command Center
AVN	Aviation
AWC	Aviation Weather Center
CM	Configuration Management
D	Demonstration
DT&E	Developmental Test and Evaluation
Eta	Eta Forecast Model (the Greek letter Eta is used as the model name)
FAA	Federal Aviation Administration
FAT	Factory Acceptance Testing
FBWTG	FAA Bulk Weather Telecommunications Gateway
FTP	File Transfer Protocol
HF	Human Factors
I	Inspection
ICD	Interface Control Document
ID	Identification
I/O	Input / Output
IP	Internet Protocol
IPT	Integrated Product Team
IR	Interface Requirements

IRD	Interface Requirements Document
ITWS	Integrated Terminal Weather System
LAN	Local Area Network
MDCRS	Meteorological Data Collection and Reporting System
MOE	Measure of Effectiveness
MOP	Measure of Performance
MOS	Measure of Suitability
MTBF	Mean Time Between Failures
MTTR	Mean Time To Repair
NAS	National Airspace System
NCEP	National Centers for Environmental Prediction
NIMS	NAS Infrastructure Management System
NFU	NWS Filter Unit
NWS	National Weather Service
NWSTG	National Weather Service Telecommunications Gateway
OI	Operational Issue
OR	Order
ORD	Operational Requirements Document
OT	Operational Test
OT&E	Operational Test and Evaluation
OTP	Operational Test Plan
PMP	Program Management Plan
PTR	Program Trouble Report
RID	Review Item Discrepancy
RMA	Reliability, Maintainability, and Availability

RUC	Rapid Update Cycle
SAT	Site Acceptance Testing
SM	System Monitor
SOW	Statement of Work
SPEC	Specification
SRS	System Requirements Specification
T	Test
TBD	To Be Determined
T&E	Test and Evaluation
UTC	Universal Coded Time
VRTM	Verification Requirements Traceability Matrix
WARP	Weather and Radar Processor
WMO	World Meteorological Organization
X	Not Applicable

APPENDIX A

VERIFICATION REQUIREMENTS TRACEABILITY MATRIX

VERIFICATION REQUIREMENTS TRACEABILITY MATRIX			
Paragraph #	***Requirement(s)***	***Test ID***	***Method***
OPERATIONAL REQUIREMENTS NAS-XX-XXXXXXX			
3.2.1	Operational Concept • Acquisition Mode • Dissemination Mode • Data management Mode • System Monitoring and Control Mode	I-01, S-01 – S-02, E-01	D
	Acquisition Mode – FBWTG shall acquire weather messages from the NWSTG as files containing message sets	I-01	D
2.2.1	Provide telecommunications pathway between NWS and FAA	I-01, E-02	D
2.2.1.1	Provide adequate throughput rate	I-01	A
2.2.2	FBWTG Subsystem shall acquire Eta, AVN, RUC gridded weather forecast data, and MDCRS airborne weather observation data from the NWSTG.	I-01	A, T, D
2.2.2.1	Detect Transmission Error	I-01, S-01, E-01	T
2.2.2.2	Re-acquire Data Following Transmission error	I-01, E-01, D-01 – D-04, S-01	T
	Dissemination Mode - The FBWTG shall disseminate messages to the NAS bulk weather recipients	I-01	X
2.2.3	Provide Weather Data to WARP and ITWS	I-01	D
2.2.3.2	Transmit Data within Specified Time Frame	I-01	T
2.2.3.3	Transmit Data in Specified Order	I-01	A, T, D
2.2.4	Process Weather Data Re-Transmission Requests	I-01	A, T, D

2.2.4.1	Receive Re-Transmission Requests	I-01	A, T, D
2.2.4.2	Evaluate Re-Transmission Requests	I-01	A
2.2.4.3	Re-Acquire Data Following Re-Transmission Requests	I-01	A, T, D
2.2.4.4	Re-Transmit Data to WARP and ITWS	I-01	A, T, D
NAS 1000 REQUIREMENTS TRACEABILITY MATRIX			
NAS-1000	Data Management Mode - • Product reception log, alert log, product dissemination log and system operations log • Retention and database update functions	I-01	A, T, D
2.4	Backup/Degraded Mode Requirements	I-01, E-01	A, T
2.5	Supportability - • NAS System Requirements Specification (SRS) • FAA-OR- 6000.30B	S-01 – S-02	A
2.5.1	Availability - • Maintain Availability of 0.99982	S-01 – S-02	A, T
2.5.2	Reliability - • MTBF of 2,777 hours	S-01	A, T
2.5.3	Maintainability - • MTTR shall be no more than 0.5 hours	S-01, I-01	A
2.5.4	Frequency of Maintenance Actions - • limited to three per year	S-01, I-01	A
NAS ????	Backup Power Source	I-01	A
5.0	Support Concept • Status of External Interfaces • Resource Utilization • Errors • Reporting • NAS Infrastructure Management System (NIMS) • Housekeeping Functions	I-01, E-01, D-03, S-01 – S-02	A

3.3	Planned Life Cycle - Evolutionary communication system that will need to be upgraded as FAA weather requirements change	E-04	N/A
NAS ????	Provide Upgradable Throughput rate	I-01, E-04	A
NAS IRS VERIFICATION REQUIREMENTS TRACEABILITY MATRIX			
NAS-IR-90029414	NWSTG / FBWTG IRD	I-01	A, T, D
NAS-IR-94142514	FBWTG / ITWS IRD	I-01	A, T, D
NAS-IR-XXXXXX	FBWTG / WARP IRD	I-01	A, T, D
NAS OPERATIONAL VERIFICATION			
MOE	Measure of Effectiveness	E-01 – E-04	A
MOS	Measure of Suitability	S-01 – S-05	A
MOP	Measure of Performance	I-01	A

APPENDIX B

OT&E TEST EVALUATION MATRIX

OT&E TEST EVALUATION MATRIX

USER OPERATIONAL TEST:	DATE:

OBSERVANCE	EVALUATION CRITERIA	DISCREPANCY	*REMARKS
	DOCUMENTATION		
	Completeness		
	Availability		
	TRAINING		
	Effectiveness		
	Hands-On		
	HUMAN FACTORS		
	Error Detection		
	Safety		
	LOGISTICS		
	Expediency		
	Turn-Around		
	SYSTEM MAINTENANCE		
	Expediency		
	Turn-Around		
	SECURITY		
	Expediency		
	Turn-Around		

*ALL failures/discrepancies require explanation in remarks column

SIGNATURE: _____

Impact **(Circle One)** *HIGH* *MEDIUM* *LOW* *NONE*

APPENDIX C

PROBLEM TROUBLE REPORT

PROBLEM TROUBLE REPORT		PTR#:	
Originator:	**Date:**	**Time:**	**AM PM**
Problem:	**Software Version:**		
	Test Configuration:		
	Test Data:		
	Error Category:		
Solution:	**Priority** *(select one)*: **1** = high **2** = medium **3** = low		
	Severity Code *(select one)*: **1** = Critical **3** = Non-Critical **2** = Critical / Work Around **4** = Cosmetic / Insignificant *(explain)*		

STATUS HISTORY

Date	Status	Updated By